

Evolution of Groundwater Hydrocarbon Plumes: Application of Prior Probability Distributions for Site Assessment and Risk Characterization. Brendan P. Dooher and Walt W. McNab, Jr., Lawrence Livermore National Laboratory, Richard Rempel, State Water Resources Control Board.

Interest in the self-limiting life-cycle of fuel hydrocarbon (FHC) plumes as justification for using natural attenuation in concert with risk management approaches has received attention because of two statistically-based studies (Rice et al., 1995, and Mace et al. 1997). Both studies have indicated that FHC plumes are limited in spatial extent, stabilizing and in many cases receding at relatively short distances from the point of release. Using forecasts derived from a Monte Carlo analysis of an analytical solution to the advection-dispersion solute transport equation, similar distributions may be produced. These forecasts include as input parameters probability distribution functions (PDFs) that are derived using historical studies from a number of sources, as well as best professional judgment. These prior distributions are designed to represent the complete population of subsurface parameters as measured statewide. Forecast distributions of plume lengths, the general trend of plume length vs. maximum site concentration, and the plume life-cycle of growth, stability and decline, are in good agreement with the statistically-based studies. An understanding of the characteristics of plume life-cycles are then derived. Using the above, it is hypothesized that when site hydrogeological information is sparse or non-existent, the above method may be used to fill in data to produce forecasts of FHC plume behavior at the site in question. An interpretation may then be made as to how much additional site-specific data need be collected in order to reduce uncertainty associated with assessing the hazard. This hazard posed by residual hydrocarbons to current or probable future receptors would depend on whether or not conservative assumptions indicate probable risk to those receptors.

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